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EMPIRICAL STUDIES IN PSYCHOLOGY

MAY 13– 16th, 2021
FACULTY OF PHILOSOPHY, UNIVERSITY OF BELGRADE

INSTITUTE OF PSYCHOLOGY
LABORATORY FOR EXPERIMENTAL PSYCHOLOGY
FACULTY OF PHILOSOPHY, UNIVERSITY OF BELGRADE

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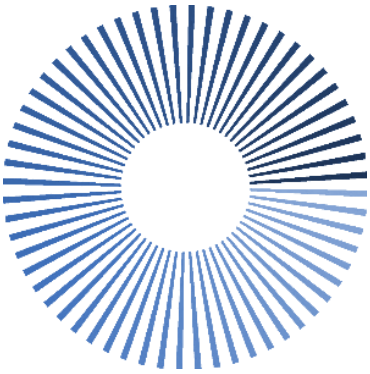
Institute of Psychology, Faculty of Philosophy, University of Belgrade



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Belgrade, 2021

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TUNING FORKS (E. Zimmermann, Leipzig – Berlin)
Instruments for generating tones of a given frequency. They are used in studies of auditory sensitivity for determining the differential, absolute and upper thresholds. Figure shows a set of three tuning forks generating the C-major chord, each fork generating the tones of 256 Hz (c^1), 320 Hz (e^1), and 384 Hz (g^1) respectively. The forks were tuned to the pitch of the originals from the German Physico-Technical Imperial Institute (Phys.-techn. Reichsanstalt).

Impact of the Visual Characteristics of the Stimulus on the Stroop Effect

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Abstract

Stroop effect is based on interference between color of word and color of font. Reading words is an automatic process and is faster than naming the color of a word. The aim of this research is to examine the Stroop effect and the automaticity hypothesis if there is only a partial mismatch between the name of the color and the color in which the word is written (partially incongruent stimuli, with the first three or last three letters being incongruent). The sample consisted of 72 participants. One factor was varied - the visual appearance of the stimulus with four levels (congruent, incongruent, partially incongruent anterior and partially incongruent posterior stimuli). The dependent variable was the reaction time and the number of errors. Results show that there is an effect of experimental manipulation on the reaction time. Stroop effect was strongest when first three letters were incongruent with written word.

Keywords: Stroop effect, visual characteristics, congruent stimuli, non-congruent stimuli

Introduction

The Stroop effect is a cognitive phenomenon that is reflected in the inhibition of the response in the task of naming colors when the name of the color is incongruent with the color with which the word is written. Such cognitive interference occurs when the processing of one stimulus characteristic affects the simultaneous processing of another attribute of the same stimulus (Stroop, 1935). It refers to a prolonged response time when the color in which the word is written is not congruent with its semantic meaning.

This effect is based on the interference between reading the word in color and the perception of the color of the font.The process of reading words is an automatic process, ie an unintentional, fast and uncontrolled that requires minimal cognitive engagement (Kostić, 2010; Moors & Houwer, 2006), and that process is faster than naming the properties of words (MacLeod, 2015). When there is a conflict between these two sources of information, our cognitive load increases and more engagement is needed to resolve that difference. Performing multiple operations, such as reading inhibition, word color processing, and information conflict resolution, slows our responses and prolongs reaction time.

The automatic reading hypothesis was tested in a study using fully colored stimuli and stimuli where one letter was colored and the rest were gray (Besner, Stolz, & Boutilier, 1997). The results of this study showed that stimuli with a single colored letter reduced the Stroop effect compared to fully colored stimuli. The assumption that words are automatically processed to activate the semantic level was not confirmed (single-coloured-letter stimulus should produce at least as much Stroop effect as completely colored words, but this is not obtained). The difference between naming colors and reading words is also explained in the way that faster processes can affect slower ones, but not the other way around (Dyer, 1973; Cohen, Dunbar, & McClelland, 1990). Therefore, since words are read faster than colors are named, interference occurs when the task is to name a color and ignore the word. If the word matches the color it will make it easier to give an answer to the naming of the color, and if the word “conflicts” with the color (incongruent situation) its impact must be "overcome" in order to generate the correct answer which leads to longer response time (ie. interference) for the color naming process.

The aim of this study was to examine the intensity of the Stroop effect if there was only a partial mismatch between the name of the color and the color with which the word was written (partially incongruent stimuli). We chose to examine the effect of incongruence of the first three letters in a word based on the research findings on the preferred landing position in reading (McConkie, Kerr, Reddix, & Zola, 1988). The incongruence of the last three letters would then be the opposite of that position and could have a different effect in the Stroop task.

Method

Sample

Total of 72 students participated in the experiment. All the subjects were students at two departments (Psychology and Pedagogy) at the Faculty of Philosophy in Banja Luka. Subjects were randomly divided into four equal groups that corresponded to the experimental condition.

Design and Procedure

One factor was varied - the *visual appearance* of the stimulus with four levels (congruent, incongruent, partially incongruent anterior and partially incongruent posterior stimuli). Partially incongruent stimuli were stimuli in which the first three or last three letters are in a different color from the color the word represents. An example of stimuli is shown in Figure 1.

Figure 1. Examples of stimuli in experiment

Factor was not repeated by participants. The classic Stroop task was used in the experiment. Participants were asked to select the color of the presented stimulus (word) by pressing the appropriate key. Five colors were selected: red, green, blue, purple, and brown. Each word appear in all other colours in incongruent condition. Every word-color combination was repeated twice. All participant went through 40 trials and additional 5 trials for practice.

Results

Results show that there is an effect of experimental manipulation on the reaction time ($F(3,2875) = 23.109$, $p < .001$, $\eta^2 = .024$). Scheffe post hoc analysis showed that the average response time was shortest for congruent stimuli (952.9 ms), then for incongruent stimuli (1097.3 ms) and partially incongruent stimuli in which the last three letters were opposite to the written word (1070.6 ms), while the longest response time present in partially incongruent stimuli in which the first three letters are opposite to the written word (1182.3 ms). Those results are shown on Figure 2.

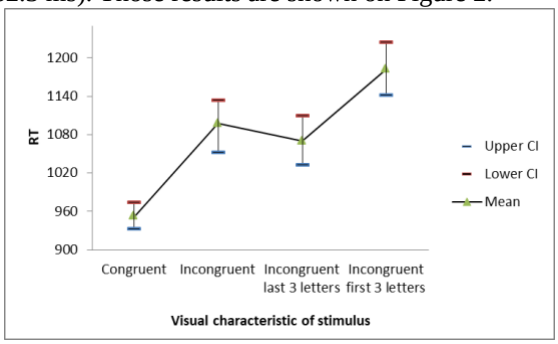

Figure 2. Reaction time depending on the visual characteristic of stimulus

Analysis of the number of errors shows that there is no statistically significant effect of the visual characteristics of the stimulus ($F(3,2875) = 1.492$, $p > .05$, $\eta^2 = .002$).

Discussion and conclusion

Stroop task is one of the most commonly used tasks to test the reading automaticity hypothesis. This process is fast, unwilling and ballistic. According to this hypothesis, it is sufficient to simply present the word in order to activate its semantic processing. Testing this hypothesis, Besner and co-workers (Besner, Stolz, & Boutilier, 1997) showed that displaying a word in which only one letter is colored significantly reduced the Stroop effect. This study examines the occurrence of interference in the case where the beginning or end of a word is colored differently. The obtained results show that Stroop effect is most pronounced in partially incongruent stimuli in which the first three letters are opposite to the written word. On the other hand, the interference is the same for completely incongruent stimuli and partially incongruent stimuli where the last three letters are opposite to the written word. These results are not fully consistent with the findings of Besner et al. (Besner, Stolz, & Boutilier, 1997). There was no reduction of the Stroop effect, but even an amplification in the case of the incongruence of the first part of the word. Although the presence of a word on a display or visual field generally always activates its semantic representation in long-term memory (Brown, Gore, & Carr, 2002), such an obligatory process can be shaped or delayed. It has been established that the type of task and the mental set, and even the way of answering (verbally or manually) significantly influence the automatic recognition of words (Risko, Stolz, & Besner, 2005). The same authors found an important role of attention, especially spatial. In conditions of high attentional load or directing attention, limitations of word recognition can be observed. Such findings may explain the stronger interference in the case of words in which the first three letters are colored differently. Attention is actively focused on the beginning of the word in an attempt to identify it. This is supported by the fact that the place where the eyes first fixate in a word during continuous reading, called the preferred landing position. This position is usually located halfway between the beginning and the middle of the word (McConkie, Kerr, Reddix, & Zola, 1988; Radach & Kempe, 1993). These were the first three letters in this study. Initiated processing of the first part of the word encounters inconsistency with the remaining part, which leads to interference. The result is prolonging the reaction time for this category of stimuli which implies stronger Stroop effect.

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